results on wheat in the following table, showing the mean molecular proportions of the 3 component salts and the ionic ratios for the culture solutions giving the best and the poorest growth of wheat during the different periods of development. They promise a full discussion of data with the publication of

Series and growth rank		Mean molecular proportions in tenths of total concentration		
		KH_2PO_4	$Ca(NO_3)_2$	$MgSO_4$
Series 1 first period	Best 9	3.4	4.7	1.9
	Poorest 9	3.8	2.0	4.2
Series 2 second period	Best 9	3.5	4.6	1.9
	Poorest 9	2.7	1.5	5.8
Series 3 third period	Best 9	2.0	5.5	2.5
	Poorest 9	6.1	1.8	2.1

results of experiments, now being carried on at the Maryland Experiment Station on the nutrient requirements of soy beans and buckwheat.

All this work indicates that SACHS, KNOP, and others had not nearly exhausted the subject of desirable nutrient solutions for water and sand cultures, but that we still have much to learn. The concentration of the nutrient salts used in these solutions are far above those existing in the general soil solution, and upon the whole the immediate significance of this work in problems of soil fertility is not evident. In the soil the dissolving power of well developed root hairs in contact with nutrients of low solubility introduces a new and important feature. It must be stated, however, that HIBBARD'S work offers indications of an important bearing of this method on questions of soil fertility.—WM. CROCKER.

Respiration and age of plant organs.—NICOLAS[11] has studied the respiration of very young leaves and leaflike structures in comparison with that of the corresponding fully developed organs taken from older parts of the same plants. In a few cases he included also a comparative study of the respiration of sections of the stem or branch bearing the young and old leaves. His material was selected from 15 different species, including annuals, biennials, and perennials. The studies were conducted by the method of confined atmospheres in absence of light at temperatures from 15 to 24° C., the gas analysis being made with the Bonnier-Mangin apparatus. Respiratory intensities were calculated on the basis of the fresh weight of the materials used. The "internal respiration" also was determined in a few cases, using hydrogen atmospheres. Respiratory quotients CO_2/O_2 and the ratio I/N between "internal respiration" and normal

[11] NICOLAS, G., Contribution a l'étude des variations de la respiration des végétaux avec l'age. Rev. Gen. Botanique **30**: 214–225. 1918.

respiration are given, the former varying from 0.58 to 1.06 and the latter from 0.13 to 1.38.

In every case the young organ, whether leaf, cladode, or branch, had a greater respiratory intensity, a larger respiratory coefficient, and a lower intramolecular respiration than the corresponding older organ. This is true whether very young organs or organs in a somewhat later stage of development are compared with fully developed organs of the same year's growth or fully developed organs of the current year's growth are compared with organs of the previous year's growth (leaves of *Olea europea* L.).

The magnitude of the differences in respiratory intensity between young and old organs varied rather widely in the different species studied, and was evidently related to the relative differences in age. In general the respiratory intensity of the young organs was from 3 to 7 times that of the older organs.

The author reviews the work of previous investigators, all of whom agree that the respiratory intensity of young organs is greater than that of the corresponding older organs. Especially interesting in this connection are the studies of BONNIER and MANGIN,[12] of MAIGE,[13] and of Mme MAIGE,[14] as cited by NICOLAS in his article. BONNIER and MANGIN found two maxima for respiratory intensity in the seasonal development of a plant, one at the opening of the leaf buds or at the germinative period, the other at the time of flowering. MAIGE found that, while the respiratory intensity of flowers decreases with age when calculated on either wet or dry weight, it increases when stated in terms of amount of gaseous exchange per individual flower, and Mme MAIGE pointed out a decrease in respiratory intensity in each organ of the flower except the gynecium, where it sometimes increases with age.

The author gives reasons why it is thought that the respiratory differences observed between young and old organs cannot be explained by the absence of well developed cuticle in very young organs, the relative amounts of chlorophyll in the tissues, or the greater acidity of young organs, and raises the question whether they may not be referred to the activities of diastase and oxidase. Finally, the author refers to a previous paper with Mme MAIGE,[15] in which it was shown that increase in turgescence increases both the respiratory quotient and the respiratory intensity, and concludes that the turgescence of young

[12] BONNIER, GASTON, and MANGIN, LOUIS, Recherches sur les variations de la respiration avec le développement des plantes. Ann. Sci. Nat. Bot. VII. 2:315–364. 1885.

[13] MAIGE, M. A., Recherches sur la respiration de la fleur. Rev. Gen. Botanique 19:1–28. 1907.

[14] MAIGE, Mme G., Recherches sur la respiration des differéntes piéces florales. Ann. Sci. Nat. Bot. IX. 14:1–62. 1911.

[15] MAIGE, Mme A., and NICOLAS, G., Recherches sur l'influence des variations de la turgescence sur la respiration de la cellule. Rev. Gen. Botanique 22:409–422. 1910.

growing organs is of importance in determining the character and amount of their respiration.

The author's conclusions are as follows: "In young organs, principally leaves, intramolecular combustions are more complete than in older organs; young tissues consume much more oxygen than those completely developed, fix relatively less, and thus set at liberty greater quantities of energy, which they use in growth."—G. T. Harrington.

Catalase, respiration, and vitamines.—Dutcher[16] finds that the catalase activity of polyneuritic pigeons is very low, and that it rises to normal when the fowl is fed water soluble vitamine. His results are given in the following table:

Catalase activity of tissues

Tissue	Polyneuritic pigeons, percentage of normal	Polyneuritic pigeons receiving water soluble vitamine, percentage of normal
Liver	44	110
Kidney	53	102
Pancreas	33	115
Heart	34	86
Breast	13	152
Lung	57	84
Blood	75	56
Average	44	101

The author says: "It is probable that polyneuritis is accompanied by incomplete or partial oxidation, with accumulation in the tissues of products of incomplete oxidation. It is also probable that water soluble vitamines function, directly or indirectly, in stimulation of oxidation processes, thereby clearing the tissues of toxic materials. When pigeon tissues are arranged in the order of their catalase content (as measured by the oxygen liberated from hydrogen peroxide), tissues group themselves in the order of their metabolic activity and also in the order of their content of water soluble vitamine."

Appleman[17], in a recently published article, says: "Respiration in sweet corn in the milk stage is very high when the corn is first pulled. This high rate of respiratory activity falls off rapidly with storage. Catalase activity in a collateral set of ears showed a decline with storage, which is almost directly proportional to the decline in respiratory intensity after a like period of storage. The catalase activity of the expressed juice from both sweet corn and potato

[16] Dutcher, R. Adams, Vitamine studies. I. Observations on the catalase activity of tissues in avian polyneuritis. Jour. Biol. Chem. **36**:63–72. 1918.

[17] Appleman, C. O., Respiration and catalase activity in sweet corn. Amer. Jour. Botany **5**:207–209. 1918.